LANDSAT TECHNOLOGY TRANSFER TO THE PRIVATE AND PUBLIC SECTORS THROUGH COMMUNITY COLLEGES AND OTHER LOCALLY AVAILABLE INSTITUTIONS

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September 1980
Type II Report for the Period of May through August 1980

Prepared for:

NASA HEADQUARTERS
Washington, D.C. 20546

TECHNICAL REPORT STANDARD TITLE PAGE

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
147200-10-P		

4. Title and Subtitle	5. Report Date
Landsat Technology Transfer To The Private And Public Sectors Through Community Colleges And Other Locally Available Institutions	September 1980
	6. Performing Organization Code
7. Author(s)	8. Performing Organization Report No.
Robert H. Rogers	147200-10-P
9. Performing Organization Name and Address	10. Work Unit No.
Environmental Research Institute of Michigan P.O. Box 8618 Ann Arbor, MI 48107	11. Contract or Grant No. NASW-3308
	13. Type of Report and Period Covered Type II May - August 1980
12. Sponsoring Agency Name and Address NASA Headquarters (Code ETS-6) 600 Independence Ave., S.W. Washington, D.C. 20546	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

This paper reports on the results achieved during the first eight months of a NASA program to transfer Landsat technology to practicing professionals in the private and public sectors (grass roots) through community colleges and other locally available institutions. The approach offers "hands on" interactive analysis training and demonstrations through the use of color desk-top computer terminals communicating with a host computer by telephone lines. The features of the terminals and associated training materials are reviewed together with plans for their use in training and demonstration projects.

17. Key Words	18. Distribution Statement
Landsat Technology Transfer Training Computer Processing Information Management	

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified		

ERIM

TABLE OF CONTENTS

1

BACKGROUND

Since the initiation of the Landsat program, most government technology transfer efforts dealing with Landsat use have been focused primarily on the public sector - Federal agencies and State governments - and have not involved the private sector to any significant extent. The application of Landsat data in the private sector has been limited primarily to the private suppliers of Landsat data processing and analysis equipment and services - aerospace companies and a limited number of users in sectors such as the mineral and petroleum industry and timber companies. However, there are many other potential private users who have not yet incorporated Landsat technology in their array of services; some examples are architectural and engineering firms, computer data processing firms, energy and environmental companies, and other consultants providing services in land use planning and development. Lack of greater involvement by these potential users has retarded the growth of Landsat technology, since engineering firms do much of the land-use mapping for both government and private industry.

Recent surveys (Rogers, 78)* show that a large number of potential users in the private sector and at local agencies are interested in becoming consumers or suppliers of Landsat-derived products and services. However, they have been prevented from entering this market by the high cost of analysis facilities and the difficulty of obtaining training in the new technology. The overall objective of this NASA program is to evaluate methods for bridging this gap by making Landsat technology readily available to a broader set of private sector firms through local community colleges and univeristies.

*Rogers, R.H. 1978. Unpublished, User Needs Survey for Remote Analysis Stations. Bendix Aerospace Systems Division, Ann Arbor, MI.

The methodology employed in this program gives users an opportunity to obtain "hands-on" training in data analysis techniques, using a desk-top, interactive "Remote Analysis Station" (RAS). The RAS communicates with a central computing facility via telephone line, and provides for generation of land cover maps and data products via remote command.

To achieve the desired objective — the successful transfer of Landsat technology — the 12-month program is working towards the following specific objectives:

- Develop plans and select program participants (e.g., colleges, engineering firms, etc.) to demonstrate effective methods of transferring Landsat technology to the private sector and local agencies at the "grass roots" level.
- Develop an operating methodology for the remote, interactive analysis of Landsat data and the generation of the output product.
- Develop and implement technology transfer and training at "grass roots" level.
- Develop a plan for expanding the technology transfer program, preferably on a self-sustaining pay-as-you-go basis for users, with seed money for community college training grants only.

2

TECHNICAL APPROACH

To accomplish the program objectives, a model network (refer to Figure 1) is being evaluated where the basic partners are NASA, a university or research institute, community colleges, and local-private and public organizations. In this investigation, a portion of the network is represented by the Southeastern Michigan Technical Assistance Program (SEMTAP) composed of ERIM and 13 community colleges. SEMTAP is a consortium of institutions dedicated to the development of a cost-effective, technology transfer network for the State of Michigan.

The role of the university or research institute is to provide host computer services for the Remote Analysis Station (RAS), develop training packages and programs, and to support seminars, minicourses and workshops staged by the community colleges. For their part, the colleges will classify and organize business and industry in their neighborhoods in accordance with technical or information needs, organize and host seminars for potential users and suppliers of Landsat data products, and serve as local contact points for technical assistance.

Between 22 September and 19 December this program will support three cooperative technology transfer efforts to be delivered in southeast Michigan. The model being evaluated in these programs is one where the college establishes an agreement with several other local organizations in order to facilitate hands-on training on the terminals over a larger region. Through this agreement the participants provides, at no cost to the college a host facility for the terminals and in turn obtains their use in demonstration projects to product Landsat products for use in on-going projects, to generate user awareness material, to train staff, and to evaluate the RAS as an initial low-cost operational Landsat data analysis capability.

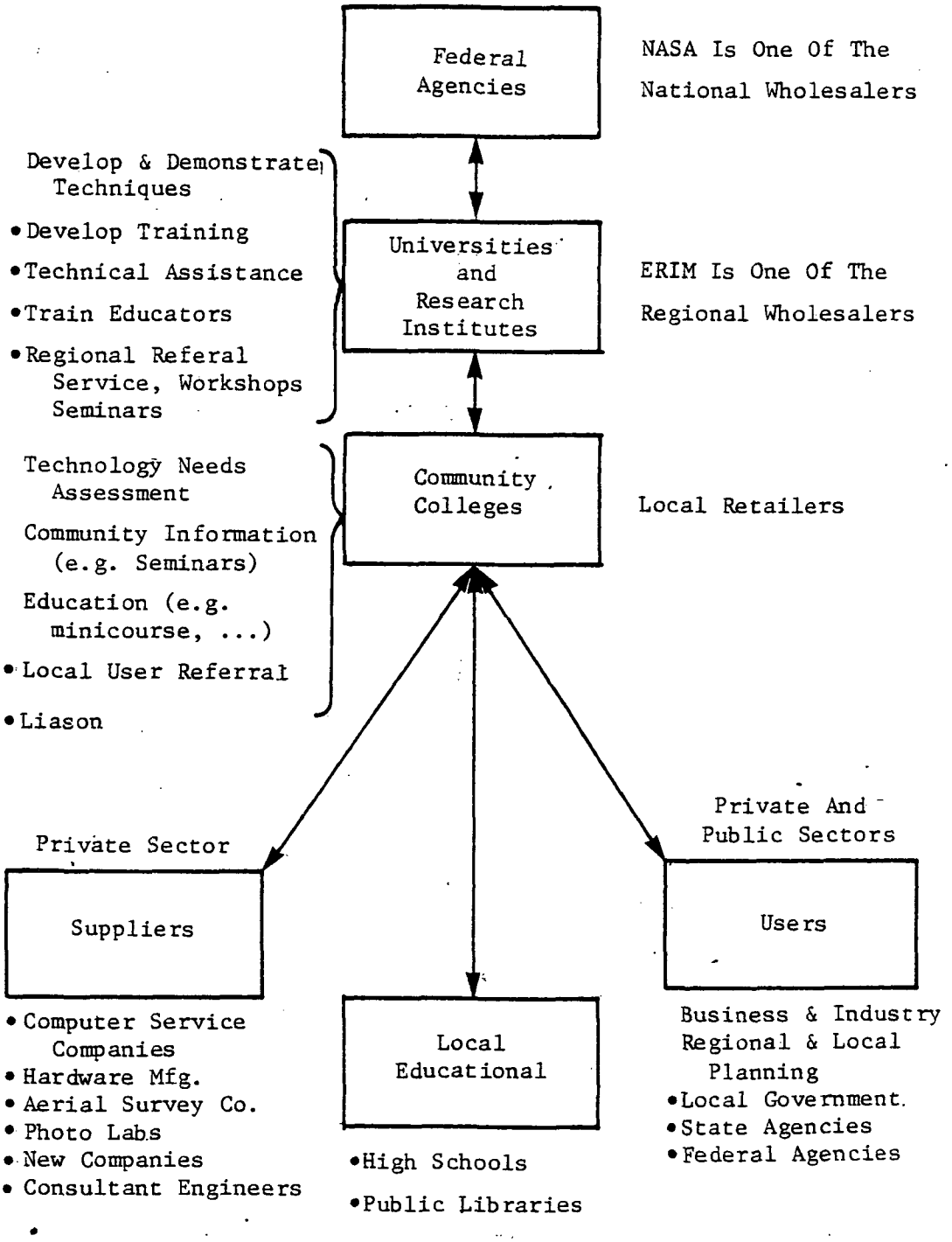


Figure 1 Model network to extend Landsat technology to the private and public sectors at the local level.

Thus the university or research institute, acting as the "wholesaler" of Landsat technology, provides backup to the community colleges, helping link the creative resources of NASA with local organizations. The community colleges, or "retailers," identify local needs and develop transfer activities geared to those needs in both the private and public sectors. This concept for training and education utilizes existing organizations; one of its greatest strengths is that the various people and organizations occupy roles for which the required positioning and motivation have already been established (Brown, 78).*

Through the work with SEMTAP, this program will determine the best procedures for working with universities and community colleges in the transfer of Landsat technology to local users. This experience will provide a solid basis for developing plans to activate the resources of other academic institutions as part of a national delivery system for Landsat and other technologies. There are 1,240 community colleges and technical institutions in the United States, located in 426 of the 435 congressional districts (1977 data); each of these institutions has close connections with various public and private local organizations that could benefit from the use of Landsat — or more directly, from the information it provides. The close relationship between the community colleges and the local communities makes the college ideal for transferring remote sensing technology.

*Brown, W.B. 1978, Remote Sensing Technology User Development Activities, Presented at the Hearings of the Subcommittee on Space Science and Applications, Committee on Science and Technology, United States House of Representatives, Washington, D.C.

3
SUMMARY OF RESULTS

To facilitate comparison between the work accomplished and the four program objectives, Section 4 is organized into 4 sections having the same titles as the program objectives. This is followed by Section 5, which summarizes program results and plans — including a schedule for the remaining work — and by the conclusions in Section 6.

Section 4.1 reports on workshop and other activities to establish programs and participants for three cooperative efforts designed to deliver Landsat technology at the local level. The first cooperative effort (Section 4.1.1) is scheduled for 22 September to 4 October 1980 and consists of a two-week seminar offered for credit or non-credit by Eastern Michigan Univeristy (EMU) with an alternative training site Daedalus Enterprises. Daedalus will also be using the terminal to train 10 or 12 of its employees and to conduct demonstration projects needed to evaluate its role as a potential supplier of Landsat products and services.

The second cooperative program (Section 4.1.2) is scheduled for the period of 15 October to 20 November 1980. This effort, organized as a seminar by C.S. Mott Community College, will include training and demonstration at the college, the office of Genessee-Lapeer-Shiawasee Region V Planning and Development Commission, and a site in the Lansing area. The third program (Section 4.1.3), organized for delivery in the 24 October through 19 December 1980 time period, is composed of a seminar offered as a non-credit course by Wayne County Community College and other demonstration and training activities involving the community college, the Southeast Council of Governments (SEMCOG), and the Detroit Edison Company. A list of names and addresses of program participants is also included in Section 5.1.

Work to support the cooperative technology transfer efforts has included the completion of the RAS terminals and associated host computer software (Section 4.2 and Appendix D), the RAS User's Manual, and a set of five exercises which all trainees work through with the terminal (Section 4.3). Section 4.3 also contains a list of nine potential instructors who have been trained in the use of the materials and 13 others who are in training. By early December, 1980 these cooperative efforts should result in about 100 participants trained in Landsat technology.

Background and planning for the next 12-month period beginning December 20, 1980 (Phase 2) is reported in Section 4.4. This plan emphasizes: continuation of cooperative efforts to involve more colleges and local users, identifying alternative sources for RAS terminals, establishing new sources for host computer service (e.g., commercial time share companies), upgrading RAS operational capability to simplify operations and to add capability to manipulate other data sources, and further upgrading of the training materials.

The program is on schedule and meeting the planned objectives. An updated schedule is included in Section 5, which summarizes plans for the remaining four months of Phase 1.

4

WORK TOWARDS FOUR PROGRAM OBJECTIVES

This section reports on the methods used and results achieved towards transferring Landsat technology to the private sector and local agencies (grass roots). To facilitate comparison between the work accomplished and the four (4) specific program objectives, the following sections have the same titles and are listed in the same order as the program objectives.

4.1 ESTABLISH NETWORK PARTICIPANTS

This objective requires development of plans and selection of initial participants for a network which will effectively transfer Landsat technology to the private sector and local agencies (grass roots). Program constraints (e.g., funding and facilities) limit the participants to two or three colleges to conduct seminars or mini-courses, three or four organizations-mainly from the private sector-to conduct demonstration projects, several instructors and assistant instructors to deliver the training, and the trainees. Activity to identify these participants has included two workshops and user awareness publications followed up with questionnaires to establish: user interest and possible applications for Landsat technology; and user preferences regarding training methods, locations for classes, etc. Criteria used to select participants included: expressed interest in remote sensing and Landsat technology; and, in the case of the private user, available application and market for use of Landsat products. Another important criterion was the willingness and likelihood that the participant will continue to use or provide training in the use of Landsat technology.

A workshop held at Eastern Michigan University, on 11 August 1980, and a following meeting with NASA provided the final inputs needed to establish initial participants. The workshop included a session where the attendees (see Appendix A for list) were subdivided by geographical regions into three working groups for the purpose of developing plans for training and demonstrations which would achieve the successful transfer of Landsat Technology in their region.

The basic model or plan which evolved for each region is one where a university or college organizes and sponsors a seminar or workshop designed to train practicing professionals in Landsat data analysis. To meet the needs for the use of the terminals for both training and demonstration projects an agreement was developed where organizations proposing demonstrations would support the seminars by providing training sites for the terminals as well as staff to help the trainees. These hosts would in turn have an opportunity to use the terminals on a time available basis to conduct the demonstration projects and to train other employees of the host facility.

This agreement or plan was used as a basis to establish three cooperative technology transfer programs scheduled for the 22 September to 19 December 1980 time period. These programs, summarized in the following three sections, demonstrate one method by which public and private organizations can join in cooperative ventures to transfer Landsat technology at the grass roots levels.

This basic agreement linking the academic institutions with private and public organizations participating as hosts for a RAS terminal follows:

1. The host organization must have one or more persons trained in the use of the terminal before it is moved on-site.

2. If the RAS terminal is made available to the public (e.g., registered trainees from outside the host organization) one

or more persons at the host facility will be identified as an associate instructor to help trainees as needed. The associate instructor will not generally receive payment from the college for the support.

3. In lieu of payment for supporting the training of registered participants, the associate instructor may use the RAS terminal on a time-available basis to conduct a demonstration project and to train other employees of the host organization. The staff being trained at the host facility would not normally pay college fees unless college credits are needed.

This agreement was used as a basis for the three cooperative technology transfer efforts summarized in the following sections.

4.1.1 FIRST COOPERATIVE TECHNOLOGY TRANSFER: 22 SEPTEMBER TO 4 OCTOBER 1980

The technology transfer activity during this first period consists of a two-week seminar offered as credit or non-credit by Eastern Michigan University (EMU), and other training and demonstrations supported by the staff of Daedalus Enterprises and EMU students and facility.

Since Dr. Eugene Jaworski of EMU prepared the original manuscript of the training package (i.e., workbooks and RAS User's Manual), he was selected to take the lead as the principal instructor for the first seminar. This program, packaged and delivered as a two-week seminar or minicourse to attract practicing professionals, is described in the brochure, Appendix B.

Another key participant in this seminar is Steve Goodman, of Daedalus Enterprises. Mr. Goodman will be the associate instructor. A RAS terminal will be on-site both at Daedalus in Ann Arbor and at EMU in Ypsilanti, Michigan, so that trainees registering for the seminar can obtain hands-on training at the most convenient location.

The RAS terminal will also be used by Steve Goodman while it is on-site at his company to train 10 or 12 other employees in the analysis of Landsat and aircraft scanner data and to carry out demonstration projects of interest to Daedalus. Daedalus is well known as a manufacturer of aircraft scanners and is using this program as an opportunity to evaluate Landsat technology and to assess its own role as a potential supplier for Landsat products and services.

Other participants in this first seminar include: Washtenaw Community College, Southeastern Michigan Technical Assistance Program (SEMTAP), and the Michigan Community College Association (MCCA). Washtenaw Community College has expressed interest in offering the seminar during the winter term beginning 12 January 1980. SEMTAP and MCCA are coordinating the results of this transfer activity with other community colleges in the state and assisting with the planning of future transfer efforts. SEMTAP and MCCA are also participants in the transfer effort being organized by C.S. Mott and Wayne County Community Colleges, which are reviewed in the following Sections (4.1.2 and 4.1.3 respectively.

4.1.2 SECOND COOPERATIVE TECHNOLOGY TRANSFER: 15 OCTOBER TO 20 NOVEMBER 1980

This technology transfer activity is being organized and sponsored by Dr. Douglas E. Laine, of C.S. Mott Community College, 1401 East Court, Flint, Michigan, 48503 (313) 762-0278. A three-day seminar at this college will be followed by hands-on training on the RAS terminal at various locations, including Mott Community College, Genessee-Lapeer-Shiawasse (GLS) Regional V Planning and Development Commission (PDC) Office, and Lansing Community College. Trainee preferences will dictate place and time for RAS terminal set-up. A program announcement is included in Appendix B.

The principal instructor for this seminar will be Robert Karwowski, who will be representing both Mott Community College and the GLS Region V Office. Associate Instructors will include John Coil of GLS Region V and Phillip E. Chase of Johnson and Anderson, a major consulting engineering organzation in Pontiac, Michigan. An Associate Instructor(s) will also be selected from the Lansing area. The centralized location of this program will facilitate contact with firms in Flint, Lansing, Saginaw, and Bay City. A radio-TV media event is planned for October 9, 1980 in Flint, Michigan, to increase public awareness about Landsat technology transfer efforts. This second cooperative effort and a third (reviewed in the following Section, 4.1.3) include non-profit regional planning agencies (i.e., GLS Region V and SEMCOG) as partners with the community colleges. This relationship facilitates marketing Landsat technology over a broader region. These planning organizations have day-to-day working contacts with targeted firms (e.g., consulting engineering organizations) and an already developed assessment of numerous community and business needs which the targeted firms service. In Michigan each county is also within a regional organization boundary providing a network which also links the region to the counties and townships. Regional organizations act as a clearinghouse for environmental, energy, transportation, housing, and economic development programs. Further, since these organizations serve clearinghouse roles, an extensive data base has been developed and serves as a repository for public and private use. Most regional organizations, for example, maintain aerial photographs, various maps (e.g., land use, topographic, soils) and other resource information on their region. This data base must be used, if applicable, by private concerns if federal funds are being requested for work in the region. This available data base can also greatly enhance the usefulness of Landsat data. Therefore, the regional planning office not only provides a well equipped office for supporting off-campus training, but it also has a well established network which can help the dissemination of Landsat technology.

When the RAS terminal is not in use by trainees registered in the seminar, Bob Karwowski of GLS V office and Phil Chase of Johnson and Anderson will be using the terminal to train other members of the GLS V Planning Office, as well as conducting a joint demonstration project of interest to their respective organizations.

The planned demonstration project will evaluate the use of Landsat data as an input to one or more non-point source (NPS) water quality models. The reliability and cost effectiveness of Landsat data will be compared to data collected from conventional sources, e.g., aerial photographs, windshield surveys, etc.

As noted previously, MCCA and SEMTAP are also partners in this joint venture.

4.1.3 THIRD COOPERATIVE TECHNOLOGY TRANSFER: 24 OCTOBER TO 19 DECMEBER 1980

This technology transfer effort is comprised of a non-credit seminar offered by Wayne County Community College and other coordinated demonstration and training activities involving students and faculty of the community college, the staff of the Southeast Michigan Council of Governments (SEMCOG), and the staff of the Detroit Edison Company. The seminars, designed to reach practicing professionals in the Detroit Metropolitian area, is being organized by Dr. Elaine Wallace, Director of Coastal Environmental Studies Project, Wayne County Community College, 8551 Greenfield, Detroit, Michigan, 38228 (313) 584-9381. Dr. Wallace is also the principal instructor for the seminar. Associate instructors include: Dan Snyder of SEMCOG and Reginald Beaslet, William Cummings, and Jarka Vit of the Detroit Edison Company. Mary Ellen Oliver, of the University of Michigan Campus in Dearborn, will be one of the teaching assistants. See program announcement in Appendix B.

To make it easy for trainees to obtain hands-on use of the RAS terminal, training sites will include the Wayne County Community College

campus on Greenfield Street (Eastern Suburb of Detroit), the downtown Detroit Office of SEMCOG, and the northern suburb office of Detroit Edison. Trainee preference may dictate additional training sites. The time the terminal remains at each site will depend upon the number of trainees and type of training at each location. In addition to making the training available to practicing professionals in the region through the seminar, the community college will also use the terminal to provide Landsat training for some trainees in its Coastal Environmental Studies (CES) Project. Please refer to Appendix C for a project brochure. The CES program was funded by the National Science Foundation to develop a Certificate Program and an Associate Degree Program in Coastal-Environmental Studies in collaboration with the Engineering and Geography Department at Wayne State University, the Michigan Sea Grant Program, the Michigan Department of Natural Resources, the Geography Department at Eastern Michigan University and local coastal and environmental agencies. This two-year program trains students for careers as technicians, aides, and attendancts in: 1) coastal research, 2) environmental studies, 3) chemical engineering, and 4) coastal planning in coastal communities. Landsat technology can be readily integrated into the CES project through its geography, geology, or computer data processing courses.

The CES project is in daily contact with and providing trained employees to consulting engineering firms, Federal, State, and Local agencies where Landsat technology may have immediate applications. Trainees from the CES program are in good demand. A list of available jobs for which students are being trained has been compiled by Dr. John Judd, Michigan Sea Grant Program, and Dr. Merle Raber, Michigan Department of Natural Resources. Representative sampling of potential employers in both private and public sectors has identified over 1,300 current positions for which these graduates will qualify.

SEMCOG and Detroit Edison will also be supporting this seminar and using the terminals to train their own staff and to evaluate Landsat applications of interest to their respective organizations.

Detroit Edison plans to explore ways of building a geographic data base for its 7600 square mile service region by integrating Landsat data with that digitized by its Interactive Graphic System (IGS). Immediate applications for this data include its use in models and analysis designed to select transmission line corridors.

Detroit Edison is exploring the possibility of installing the RAS software on its PDP-11/70 computer in order to support the training and demonstrations at its organization.

In addition to providing facilities and staff to help seminar trainees SEMCOG will also be using the terminal to investigate the use of Landsat as a possible source for updating the 1975 inventory of its seven-county planning region. The 1975 inventory was derived by interpreting and digitizing land use information from aerial photography. Anticipating the updating requirements, SEMCOG has collected new (1980) photography for the region. One method which SEMCOG is evaluating would use the Landsat data to point out possible areas of land use change and the aerial photographs to interpret these changes. The 1975 digital data base would then be edited to incorporate the changes to obtain the desired 1980 data base.

4.2 DEVELOP OPERATING METHODOLOGY

This specific objective requires the assembly of equipment and techniques by which local users can obtain the capability to develop Landsat products and services through community colleges and small universities with the aid of a remote analysis station. The development of this methodology includes the following intermediate goals:

1. Assembly and test of three desk-top RAS computer terminals which will be connected to a central computing facility by telephone lines. The three remote stations will comprise the key means to perform user training and to conduct technology demonstration projects.

2. Integration and test of the RAS, including modifications and development of new software where needed to permit RAS operation at the sites of the participating colleges and private users.

3. Develop specifications and cost estimates of the RAS and host computer operations and products preferred by users.

Work has been completed to assemble, integrate and test three RAS terminals with the host computer. A summary of the terminal features follows with a detailed description, included as Appendix D.

The RAS consists of a color CRT imagery display, with alphanumeric overwrite and keyboard, as well as a cursor controller and modem. This portable station can communicate via modem and dial-up telephone with a host computer at 1200 baud or hardwired to a host computer at 9600 baud. The station contains a Z80 microcomputer which controls the display refresh memory and remote station processing. Landsat data is displayed as three-band false-color imagery, one-band color sliced imagery or color-coded processed imagery. Although the display memory operates at 256 x 256 picture elements, a display resolution of 128 x 128 can be selected to fill the display faster. The interactive operating techniques developed by ERIM permit most of the interaction to be performed at the lower resolutions and faster display fill rates, with high-resolution capability being used for viewing the final processed data.

The RAS features the following capabilities:

- Low cost - the station can be assembled from readily available hardware for less than $20,000.
- System portability - the user supplies only electrical outlets and a telephone.
- Interactive control via a simple, menu-driven language.
- Dial-up access to host computer with selectable trade-off between image viewing speed and quality (resolution).
- Histogram display, categorization accuracy tables, and results of category separation analysis.
- Categorized image display in colors selected from list with over 40 options.
- Generation of land cover tabulations directly from display by designating boundary of area with cursor.
- Display of selected map categories over false color images.
- Input of image and map control points for geometric correction.

The Remote Analysis Station is presently used to access the ERIM Earth Resources Data Center for Landsat data processing, including the generation of film images and thematic maps.

Some software and firmware modifications will be made from time to time, as funding permits, to make the terminals simpler to operate and to incorporate features which can be justified by user needs. Additional information on RAS operating cost and user product preference will also evolve from experience and user comments gained from the operational support of the training and demonstration projects.

4.3 DEVELOP AND IMPLEMENT TECHNOLOGY TRANSFER AND TRAINING AT THE GRASS ROOTS LEVEL

This objective requires the development and delivery of a program of training and demonstrations designed to stimulate the market and encourage private users to become consumers and suppliers of Landsat products. Work towards this objective includes the following subtasks:

1. Develop a training program containing workbooks, RAS User's Manual, and other material needed to instruct potential users in Landsat data processing and applications.
2. Support two or three seminars or workshops through local community colleges and universities.
3. Support three or four demonstration projects by private engineering consulting firms and local organizations to produce Landsat products for use in on-going projects, to generate user awareness material, to train staff, and to evaluate the RAS as an initial low-cost operational Landsat data analysis capability.

Work towards these goals has been directed at developing the training material and preparing instructors and other support personnel needed to deliver the three cooperative technology transfer programs summarized in Section 4.1.

The first draft of the training program, which includes a set of five exercises which all trainees work through and a User's Manual, was completed. This program gives participants an opportunity to obtain training in the computer assisted interpretation of Landsat data and the generation of digital data bases from Landsat, aerial photography and map sources as well as to use these data bases for planning and management of the environment, natural resources, and land use.

All participants work through five exercises which involve 18 to 22 hours of training using the RAS terminals.

As noted previously, this investigation hosted a workshop for approximately 50 participants on August 11, 1980, to obtain inputs needed to develop the three cooperative technology transfer efforts. This workshop also provided the program with the first opportunity to obtain a critical review of the RAS operation and training material.

Although only 50 letters announcing the workshop were mailed, almost everyone invited appeared. The attendance list (see Appendix A) included staff from both local universities and colleges and private sector and local agencies who expressed interest in participating in the program. This workshop was also the first step in preparing potential instructors to use RAS and its training materials: the meeting also provided the program an opportunity to obtain additional inputs for upgrading the materials before use with trainees.

Nine potential instructors have been trained in the use of the RAS terminal and 13 others are in training. A list of the potential instructors trained or in training as of 22 September 1980 follows:

Trained

1.	Dr. Eugene Jaworski, EMU	PI*
2.	Steve Goodman, Daedalus Enterprises	AI**
3.	Larry E. Reed, ERIM	AI
4.	Bill Tyler, ERIM	AI
5.	Roger Reinhold, ERIM	AI
6.	George A. Leshkevish, NOAA	AI
7.	Raj. K. Aggarauala, U of M	AI
8.	Carol Bronick, EMU	TA***
9.	Iftekhar Bhatti, EMU	TA

In Training

1.	Robert Karwowski, Michigan GSL Region	PI
2.	Phil Chase, Johnson and Anderson	AI
3.	Vince Wilson, Mott Community College (MCC)	TA

*Principal Instructor
**Associate Instructor
***Teaching Assistant

4.	Bob Fry, MCC	TA
5.	Mark Hepe, MCC	TA
6.	Dr. Elaine J. Wallace, Wayne County Community College	PI
7.	Mary Ellen Oliver, U of M Dearborn	TA
8.	Dan Snyder, SEMCOG	AI
9.	William T. Cummings, Detroit Edison	AI
10.	Jarka Vit, Detroit Edison	AI
11.	Reginald Beaslet, Detroit Edison	AI
12.	Leslie Walter, EMU	TA
13.	Lu Anne Horvath, EMU	TA

Host organizations providing facilities and staff to help trainees on the terminals, as noted in Section 4.1, include:

22 September to 4 October, 1980

1. Eastern Michigan University
2. Daedalus Enterprises

15 October to 29 November, 1980

1. C.S. Mott Community College
2. GLS Region V Planning Office
3. Lansing Community College (Agreement not firm)

24 October to 19 December, 1980

1. Wayne County Community College
2. Southeast Michigan Council of Governments
3. Detroit Edison Company

Some of these hosts may change, others may be added - trainee preference will dictate place and time for RAS terminal set-up whenever possible. As noted previously, the host organization will also be using the terminals on a time available basis to conduct demonstration projects and to train other employees. It is also anticipated that some

trainees from organizations not presently identified may also be selected from the training courses to use the terminal to undertake further work on a demonstration project of their choice.

4.4 DEVELOP PLANS FOR EXPANSION OF LANDSAT TECHNOLOGY (PHASE II)

This objective requires the development of a plan for the continued expansion of the use of Landsat technology at additional community colleges and the inclusion of more local users. Emphasis in the plan will be placed upon:

1. Continuation of cooperative technology transfer programs to involve more colleges and local users with colleges providing self support of training courses with minimum NASA grant support.
2. Identifying alternative sources for the RAS terminals by encouraging suppliers to meet user needs on an investment basis and users to procure their own terminal once a successful demonstration project is completed.
3. Establishing new sources for the host computer service by encouraging time-share companies, universities, and college computer-centers to invest in this expanding market.
4. Upgrading the operational capability of RAS terminal and host software to simplify operations and to add capability to manipulate other data sources when justified by user needs.
5. Upgrading training materials to facilitate their use by trainees and to incorporate additional exerciese needed to introduce new terminal capabilities (Item 4).

Additional background on areas to be covered by the plan is summarized in the following five sections.

4.4.1 SUPPORT COOPERATIVE TECHNOLOGY TRANSFER PROGRAMS

Additional training and demonstration efforts are needed to continue to develop and illustrate the role of community colleges in partnership with the private and public sectors in the delivery of Landsat technology at the local level. It is believed that this model extension network is being successfully demonstrated in Michigan and, if continued and expanded to a few other states, other colleges would follow nationwide. The basic partners in this model for a national technology transfer effort (Figure 1) are NASA, community colleges, research institutions, university research centers, and private sector organizations. A technology extension network, with support to community colleges paralleling present-day vocational education funding, might be a legislative goal.

4.4.2 ESTABLISH ALTERNATIVE SOURCES FOR RAS TERMINALS

Although the RAS terminals meet cost (under $20K) and performance specifications their excessive weight and size make the mobility needed for on-site training and demonstrations difficult. RAMTEK, who supplied the current hardware, has been encouraged to develop more responsive configurations. Contacts have also been made with TEKTRONICS, Science Application Inc., Log Etronics Inc., and other potential suppliers in hopes of locating alternative terminal configurations that offer cost or performance advantages. Trainees will be encouraged to purchase their own terminals from one of the available sources upon the successful completion of demonstration or training. This activity would continue through Phase 2.

4.4.3 DEVELOP ALTERNATIVE SOURCES FOR HOST COMPUTER SERVICES

Long distance telephone rates may discourage terminal use the distance between the terminal and the host increases. When the

terminal can be hardwired to the host computer and operated at 9600 baud, it displays an image eight times faster than it does when operating through dial telephone line at 1200 baud.

These factors suggest that the plan for the orderly continued expansion of the use of Landsat technology must also address the needs of transferring the RAS software operations to other host computer facilities. The academic institutions and computer time-share firms would be encouraged to add software to their computers where possible so that local users can take advantage of the faster display rates when the terminals can be hardwired to the computer or lower telephone rates if dial-line operations are needed. Large universities, college centers, and time-sharing firms are already accustomed to servicing terminal users and could adapt the RAS software and terminals in stride.

Many of the large computer time-sharing firms are now supporting many clients, e.g., consulting engineering companies who are also potential users of Landsat technology. A well designed transfer of the RAS software to one or more of these hosts could have an immediate impact on the use of Landsat technology. Preliminary contacts have been made with a few organizations, e.g., Boeing Computer Services and National CSS, Inc., in order to evaluate methods and possible benefits for accomplishing this transfer. A development of one or two alternative host computer services would be an important goal to achieve during Phase 2.

4.4.4 UPGRADING CAPABILITY OF RAS TERMINALS AND HOST SOFTWARE

Some software and firmware modifications will be needed in Phase 2 from time to time to make the terminals simpler to operate and to incorporate features which can be justified by user needs.

A more time consuming and expensive effort to undertake in Phase 2 would be the modification of the RAS software so that the terminal could be used to manipulate land cover data derived from Landsat with that in other digital files, such as soils, topography, etc. This modification would, moreover, provide a geo-based system capability that could attract a much larger number of potential users to the technology. The geo-based system capability will be added as an optional cost-feature in the Phase 2 plan.

4.4.5 UPDATE TRAINING MATERIAL

Training material, (i.e., exercises and User's Manual), as the terminal itself, will evolve and change with use to incorporate new materials and features responsive to user needs. By the end of September approximately 50 trainees will have worked through the exercises and User's Manual; by early December this number will be close to 100. Almost all trainees to date have made some comments or corrections which will improve the training material. Plans are to put the training material on a word-processing machine to facilitate revisions and additions. A Phase 2 objective will be to make the training package completely 'self contained' or as much so as possible. Ideally, a user with very little, or no background in remote sensing supplied with a training package could train himself or herself to generate Landsat maps and data products with the use of the terminal.

5
SUMMARY OF RESULTS AND SCHEDULE

The 12-month program is on schedule and meeting planned objectives. This section summarizes major accomplishments during the first eight months of activity and reviews plans for the remaining four months. Plans are also reflected in the following schedule (Figure 2), which shows the time phase relationship between remaining activities.

5.1 ESTABLISH NETWORK PARTICIPANTS

The workshop held on 11 August 1980 and a following meeting with NASA established the colleges and most of the organizations who would participate in the initial training and demonstration programs. To reach as many practicing professionals as possible within southeast Michigan, the participants were organized by region into three cooperative efforts for the purpose of delivering the training and demonstrations. The time periods for these efforts and a list of the host organizations providing facilities and staff to help trainees on the terminals follows:

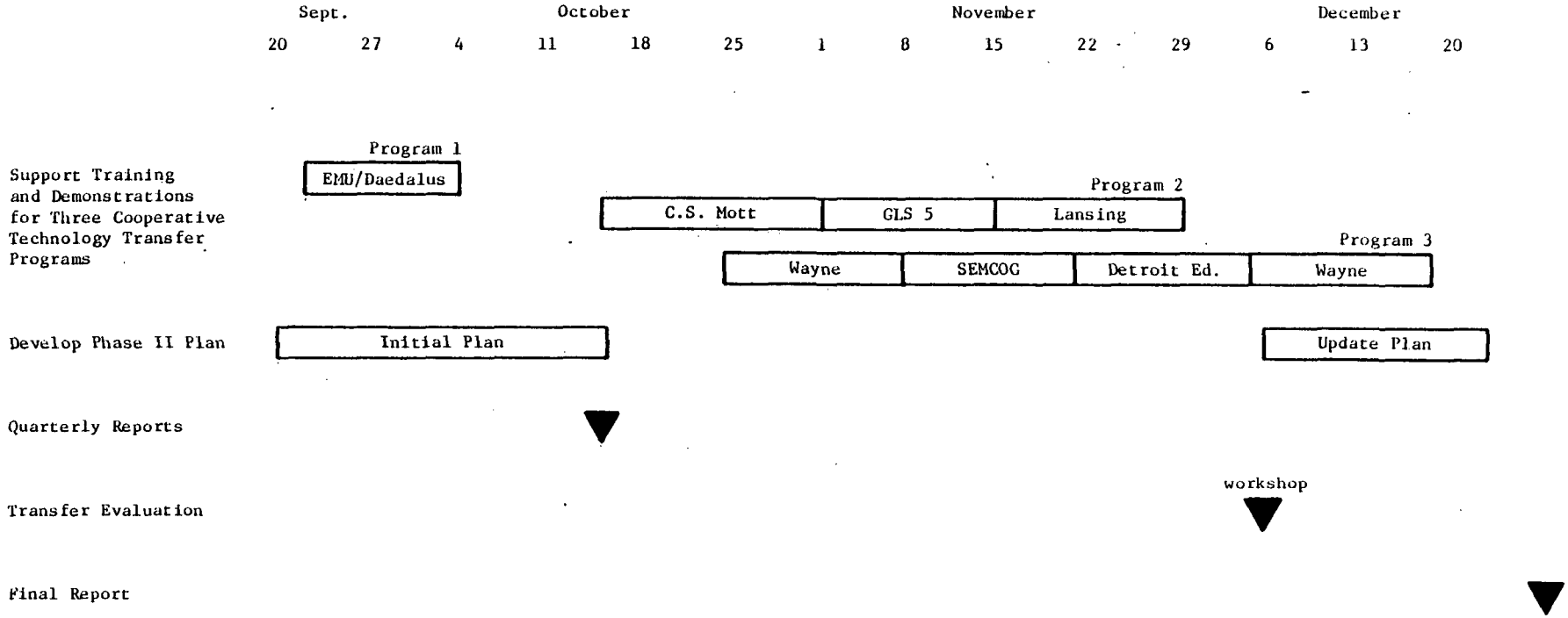
22 September to 4 October 1980

1. Dr. Eugene Jaworski, (313) 487-1480
   Geography and Geology Department
   Eastern Michigan University
   Ypsilanti, Michigan 48197
2. Steve Goodman (313) 769-5649
   Daedalus Enterprises
   Ann Arbor, Michigan 48106

15 October to 29 November 1980

1. Dr. Douglas E. Laine (313) 762-0278
   C.S. Mott Community College
   1401 East Court
   Flint, Michigan 48503

Figure 2 Program Schedule



2. Robert Karwowski (313) 766-8593
   Michigan GLS Region
   Planning and Development Commission
   1602 West Third Ave.
   Flint, Michigan 48502

3. Morris Thomas (517) 373-7048 (Tentative)
   Lansing Community College
   Lansing, Michigan 48901

   and/or

   Bill Enslin (517) 353-7195 (Tentative)
   Center for Remote Sensing
   Michigan State University
   201 UPLA Bldg.
   East Lansing, Michigan 48824

24 October to 19 December 1980

1. Dr. Elaine J. Wallace, Director (313) 584-9381
   Coastal Environmental Studies Project
   Wayne County Community College
   8551 Greenfield
   Detroit, Michigan 48228

2. Dan Snyder (313) 961-4266
   Southeast Michigan Council of Governments
   800 Book Bldg.
   Detroit, Michigan 48226

3. William T. Cumming (313) 649-7349
   Detroit Edison Company (Room 356 E.C.T.)
   200 2nd Ave.
   Detroit, Michigan 48226

The role of the academic institution in each group is one of sponsoring a seminar designed to attract practicing professionals to a program of training in the applications of Landsat data and in the use of the terminals to produce land cover maps and data products. The other participants, listed in this table, provide off-campus sites for the terminals where trainees can obtain additional hands-on training. An objective is to pick a host for the terminal that will be convenient to the largest number of trainees. The host organizations will also be using the terminals on a time available basis to conduct demonstration projects and to train other employees in their organizations.

Limited by resources (e.g., two terminals), this method by which public and private organizations can join in cooperative efforts to share resources seems to be a good method of satisfying both training and demonstration requirements and in turn transferring Landsat technology to the largest number of professionals at the grass roots level.

5.2 ESTABLISH OPERATING METHODOLOGY

The three (3) RAS terminals are complete and in continuous use for training and demonstrations. Additional information on operating cost and user product preference will evolve from experience and use of terminals in support of training and demonstration efforts.

5.3 DEVELOP AND IMPLEMENT TRAINING AND TECHNOLOGY TRANSFER

The first draft of training programs (i.e., RAS User's Handbook, set of 5 exercises) is complete. Nine potential instructors have been trained and 13 others are in training. The training package, as expected, is changing and evolving with use. Trainees have now registered and are in training in the first of the three cooperative technology transfer efforts.

Since the colleges sponsor the training programs through the usual registration fee method (which pays the instructor) and the other terminal hosts (participants) are providing facilities and staff support at no cost to NASA or the college, the training and demonstration activities are almost self-supporting. NASA's support includes the terminals with host computer support and copies of training material. A goal is to have approximately 100 participants trained in Landsat technology by early December 1980.

5.4 TRANSFER EVALUATION WORKSHOP

A workshop is planned for early December with NASA, ERIM, community colleges, universities, and local user participation to assess the

effectiveness of the training and demonstrations programs as well as the ability of the users to apply the resultant products in operational activities. Based upon workshop results, refinements in the program will be integrated into Phase 2 to the degree possible. As part of the workshop, interested hardware manufacturers and computer time-share firms will be asked to participate for an assessment of market interest on their part.

5.5 PHASE II PLAN

Planning for Phase II has started and will continue until mid October when a recommendation will be presented to NASA for continuation and expansion of the program involving more community colleges and local users. The plan will emphasis the need to:

1. Continue cooperative technology transfer efforts to develop and further illustrate the role of community colleges in partnership with the private and public sectors in the delivery of Landsat technology at the local level.
2. Identify alternative source for the RAS terminals.
3. Establish new sources for the host computer service.
4. Upgrade the operational capability of RAS terminals and host software to simplify operations and to facilitate manipulations of new data sources.
5. Upgrade training materials as needed with the objective of making the training programs fully self-contained and usable by a practicing professional with little or no prior background in remote sensing.

6
CONCLUSION

Expressions of interest from the private sector and academic institutions and encouragement to move faster with this technology transfer effort indicate that the program is on track. The investigation is demonstrating that recent developments in computer technology now make it possible for the private sector to provide high-quality Landsat products and services, using a desk-top computer terminal, at the low initial investment of about $20K. It is also showing that community colleges and several private and public organizations readily available to the local user community can join in cooperative efforts to deliver the needed training in the use of their terminals and the application of Landsat technology. In addition, this approach permits a gradual expansion of the initial low-cost user facility as confidence and available capital increase and as the system shows potential for easily merging other sources of data (soils, topography, etc.) into the Landsat analysis process.

APPENDIX A

Letter announcing August 11, 1980 workshop and attendance list.

ENVIRONMENTAL
RESEARCH INSTITUTE OF MICHIGAN
P.O. BOX 8618 • ANN ARBOR • MICHIGAN • 48107

APPROX N 50 Letter
mailed 4 AUG 1980
= Potential teachers / Host for terminal
= Organizations for Demo's

200

LANDSAT (SATELLITE) WORKSHOP AUGUST 11 . . . . . .

You have been identified as a possible participant in a NASA program to evaluate methods of transferring Landsat technology to the private sector and local agencies. Such transfers would be through community colleges and other institutions convenient to users. You are invited to a working meeting at Eastern Michigan University (EMU) to preview our training materials and plans on Monday morning (9:00 AM), August 11, 1980. The meeting will be in Room 222 of the Strong Building (see item 19 on the enclosed map).

Important activities to be reviewed at this workshop include:

- Selection of initial program participants (i.e., colleges, instructors, trainees) to demonstrate effective methods of transferring Landsat technology to the private and public sectors at the local "grass roots" level.
- Operation of the Remote Analysis Station (RAS) which gives users an opportunity to obtain "hands-on" training in Landsat data analysis at community colleges and universities.
- A training program containing workbooks, RAS operator's manual, and other material designed to train the practicing professional in Landsat data processing and applications.
- Plans for expanding the technology transfer program to include more colleges and users.

The morning meeting will be followed by a buffet provided at no charge if you will notify Shirley or Professor Eugene Jaworski, on (313) 487-1480 and inform them of your plans to attend the meeting. If you cannot make the meeting, but have interest or questions concerning this technology transfer activity, please give me a call anytime on (313) 994-1200, Extension 319.

Sincerely,

Robert H Rogers

Robert H. Rogers
Applications Scientist

LANDSAT
WORKSHOP
11 AUG 1980
ATTENDANCE LIST

1.	John Grossa	Central Michigan University	517-774-3220
2.	Roy Klopcic	Central Michigan University	517-774-3220
3.	Phil Chase	Chase-Mogdis, Inc.	313-476-2583
4.	L. A. Rivard	Consultant	514-487-6802
5.	Steven Goodman	Daedalus Enterprises	313-769-5649
6.	Kenneth Earl	Daedalus Enterprises	313-769-5649
7.	Newman G. Hussain	Dept. of Natural Res. Lansing	517-373-1275
8.	Reginald Beaslet	Detroit Edison	313-649-7358
9.	William Cumming	Detroit Edison	313-649-7349
10.	Jarka Vit	Detroit Edison	313-649-7369
11.	Clayton S. Long	Eastern MI Univ. - Computer Center	313-487-2454
12.	Bruce Bartley	Environmental Research Group	313-662-3104
13.	Buzz Sellman	ERIM	313-994-1200
14.	Jack G. Olin	General Motors Institute	313-762-7989
15.	Charles McKay	General Motors Institute	313-762-7900
16.	Morris Thomas	Lansing Community College	517-373-7048
17.	Chuck Berda	Michigan DNR	517-373-5910
18.	Bob Karwowski	Michigan GLS	313-766-8593
19.	John Baleja	Michigan State University Center for Remote Sensing	517-725-3195
20.	George Schultinu	Michigan State University Center for Remote Sensing	517-353-7195
21.	BillBuckler	Michigan State University Center for Remote Sensing	517-353-7195
22.	Ross Dodson	Michigan State University Center for Remote Sensing	517-353-7195
23.	George Scrubb	Oakland Co. Planning Commission	
24.	Robert E. Turner	Science Applications, Inc.	313-662-3261
25.	Dan Snyder	SEMCOG	313-961-4266
26.	Sharon Husted	SEMCOG	313-961-4266

27.	Chuck Olson	University of Michigan	313-764-1413
28.	Rajendra K. Aggarwala	Univeristy of Michigan	313-764-1413
29.	Ralph Barfield	University of Michigan	313-763-3044
30.	John Paul	U.S. EPA	313-226-7811
31.	Elaine Wallace	Wayne County Community College	313-584-9381
32.	Robert D. Swartz	Wayne State University	313-577-2701
33.	Larry Hackney	Washtenaw Community College	313-973-3536
34.	Ralph Pasola	Washtenaw County Planning Commission	313-994-2435
35.	Mark McFadden	Washtenaw County Planning Commission	313-99402435

APPENDIX B

Brochures announcing seminars conducted as part of the cooperative technology transfer efforts.

ANNOUNCEMENT

SPECIAL COURSE

WAYNE COUNTY COMMUNITY COLLEGE

COOPERATIVE TECHNOLOGICAL TRANSFER

NASA

- SEMCOG (South East Michigan Council of Governments)
- Environmental Research Institute of Michigan
- Michigan Community College Association
- Detroit Edison
- National Aeronautics and Space Administration
- Southeastern Michigan Technical Assistance Program

LANDSAT-REMOTE SENSING WORKSHOP

Description

This special topics course has been designed as a training-demonstration and educational tool for potential users of LANDSAT (Satellite Imagery) technology. The course gives participants an opportunity to obtain training in the computer assisted interpretation of Landsat data, generation of digital data bases for planning and management of the environment, natural resources, and land use.

Participants will work through five exercises which will involve 18 to 22 hours of training using a color, interactive "Remote Analysis Station" (RAS). The RAS communicates with a central computing facility via telephone lines, and provides for generation of land cover maps and data products via remote command.

It is anticipated that some trainees may be selected to use the RAS terminal to undertake further work on a demonstration project of their choice.

Intended Audience/Prerequisites

The course is designed for practicing professionals and students who desire a comprehensive understanding at a basic level of the pertinent concepts, potentials, problems, and trade-offs associated with the practical and operational aspects of collecting, interpreting, and merging Landsat data with other data sources and applications for these data. No formal prerequisites are required.

Training Sites

A RAS terminal will be available at:

Wayne County Community College, Northwest Region, 8551 Greenfield Road, Room A323 (October 24 - November 7 and December 8 - December 19)

SEMCOG -- Downtown Detroit (November 10 - November 21)

Detroit Edison, Troy, Michigan (November 24 - December 5)

Instructors

Principal Instructor: Dr. Elaine Wallace, CESP Director, Wayne County Community College, (313) 584-9381

Associate Instructors: Dan Synder, SEMCOG; William Cumming, Detroit Edison; Reginald Beasley, Detroit Edison; and Larry Reed, Bill Tyler, and Roger Reinhold, Environmental Research Institute of Michigan, (313) 994-1200 (ext. 576)

Training Materials

This course uses the RAS terminal, workbooks, and other material developed by the National Aeronautics and Space Administration, which is evaluating methods of making Landsat satellite technology more readily available to the private and public sectors through local community colleges and universities. The course does not require additional texts or other materials.

Cost

Registration Fee $50

Seminar Schedule

The following schedule will be adhered to. Participants will be expected to attend a two day workshop plus approximately 18 hours of terminal time.

Workshop -- October 24 9:00 a.m. - 4:00 p.m.
October 27 9:00 a.m. - 4:00 p.m.

Room A200 Wayne County Community College
8551 Greenfield
Detroit, Michigan 48228

Class Size

The course is designed to accommodate up to twenty trainees with prioity given to practicing professionals.

Registration

You may register in advance, on a first-come first-serve basis, by calling Dr. Elaine Wallace, Wayne County Community College, 584-9381 (313)

Class size will be limited to twenty.

COMMUNITY SERVICES PROGRAMS

FROM
DIVISION OF SCIENCE & MATH

SATELLITE REMOTE SENSING

Physical Science 200-2 (May be taken for Credit or Audit)
Section 7825F

Prerequisite: A Basic course in Geography or Geology, and two semesters of Algebra. (Practicing Professionals may disregard the prerequisites.)

Mott Community College will be offering a seminar on Satellite Remote Sensing during the Fall 1980 Semester.

The course has been designed as a training-demonstration and educational tool for potential users of the LANDSAT (Satellite Imagery) Technology. The course gives participants an opportunity to obtain training in the computer assisted interpretation of LANDSAT data, generation of digital data bases from LANDSAT, aerial photography and map sources; and to use these data bases for planning and management of the environment, natural resources, and land use.

Participants will work through five exercises which will involve 10 to 16 hours of training using a color, interactive "Remote Analysis Station" (RAS). The RAS communicates with a central computing facility via telephone lines, and provides for generation of land cover maps and data products via remote command.

THE DATE: October 15, 16, & 17, 1980 from 8:00 a.m. - 5:00 p.m.
and an additional 8 hours by individual arrangement.

THE COST:

Mott Community College District Resident	$55.00
Michigan Resident outside MCC District	$67.00
Out of State Resident	$91.00

COOPERATIVE TECHNOLOGICAL TRANSFER

* Charles S. Mott Community College
* Genesee-Lapeer-Shiawassee Planning and Development Commission
* Environmental Research Institute of Michigan
* National Aeronautics and Space Administration
* Michigan Community College Association
* Southeastern Michigan Technical Assistance Program

For additional information contact:

Douglas E. Laine, Chairperson Division of Science and Math
313-762-0278

SATELLITE REMOTE SENSING SEMINAR
Section 7825F

To enroll, return the form below, along with your tuition check to: Off Campus Services Office, MCC, 1401 E. Court St., Flint, MI 48503. Sessions will be filled on a first come/first served basis. You will receive a seminar admission ticket, a campus map, and class room assignment by return mail.

Name:_____ Sex: ☐ Male ☐ Female Marital Status: ☐ Single ☐ Married

Address:_____

Phone:_____ Date of Birth:_____ School District in which you live:_____

Social Security Number:___/___/___

I have attended MCC before ☐ yes ☐ no
If yes, last date attended MCC:_____

I am enrolling for: ☐ Audit ☐ Credit

YOU ARE ENCOURAGED TO REGISTER EARLY. SPACE IN CLASS IS LIMITED.

ANNOUNCEMENT

Special Course

Eastern Michigan University

NASA

COOPERATIVE TECHNOLOGICAL TRANSFER

- Daedalus Enterprises
- Environmental Research Institute of Michigan
- Michigan Community College Association
- Washtenaw Community College
- National Aeronautics and Space Administration
- Southeastern Michigan Technical Assistance Program

GEO478 "SPECIAL TOPICS: REMOTE AREA SENSING"

Description

This special topics course has been designed as a training-demonstration and educational tool for potential users of LANDSAT (Satellite Imagery) technology. The course gives participants an opportunity to obtain training in the computer assisted interpretation of Landsat data, generation of digital data bases for planning and management of the environment, natural resources, and land use.

Participants will work through five exercises which will involve 18 to 22 hours of training using a color, interactive "Remote Analysis Station" (RAS). The RAS communicates with a central computing facility via telephone lines, and provides for generation of land cover maps and data products via remote command.

It is anticipated that some trainees may be selected to use the RAS terminal to undertake further work on a demonstration project of their choice.

Intended Audience/Prerequisites

The course is designed for practicing professionals and students who desire a comprehensive understanding at a basic level of the pertinent concepts, potentials, problems, and trade-offs associated with the practical and operational aspects of collecting, interpreting, and merging Landsat data with other data sources and applications for these data. No formal prerequisites are required. The course is open to undergraduate, graduate, and non-credit trainees. Additional work will be expected from the graduate students that enroll for this seminar.

Training Sites

A RAS terminal will be available at Daedalus Enterprises in Ann Arbor and at Eastern Michigan University (Room 222, Strong Hall) in Ypsilanti, Michigan. Dr. Eugene Jaworski of Eastern Michigan University will assign trainees to the site of their choice where possible.

Instructors

Principal Instructor: Dr. Eugene Jaworski, Assistant Professor, Eastern Michigan University, Geography & Geology Department, (313) 487-1480.

Associate Instructor: Steve Goodman, Daedalus Enterprises, (313) 769-5649.

Associate Instructors: Larry Reed, Bill Tyler, and Roger Reinhold, Environmental Research Institute of Michigan, (313) 994-1200.

Training Materials

This course uses the RAS terminal, workbooks, and other material developed by the National Aeronautics and Space Administration, which is evaluating methods of making Landsat satellite technology more readily available to the private and public sectors through local community colleges and universities. The course does not require additional texts or other materials.

Credit

Two hours of undergraduate or graduate credit may be earned by completing this seminar. Enrollment on a non-credit basis is permitted. If you desire further information on non-credit, please contact Paul Borawski at (313) 487-0314.

Cost

Undergraduate		Graduate		Non-Credit
Tuition	$60.	Tuition	$84.	$60.
Registration Fee	$20.	Registration Fee	$20.	
Total	$80.	Total	$104.	

Seminar Schedule

The following schedule will be adhered to. The course will run for two weeks commencing on September 22, 1980 and concluding on October 4, 1980. It will run five days a week from 8:00 a.m. until 10:00 p.m. Students will not be expected to attend the entire time; however, they will be expected to attend at least 30 hours of instructional time during this period. The course instructors will schedule students for computer time during the two week course.

Class Size

The course is designed to accommodate up to twelve trainees with priority given to practicing professionals.

Registration

A registration form has been attached; when completed, it should be mailed to the Registration Office, Briggs Hall, Eastern Michigan University, Ypsilanti, Michigan 48197.

Similar Training Programs

Similar training programs will be offered in the October-November time period by Wayne and Charles Stewart Mott Community Colleges. These programs will deploy RAS terminals at sites in Wayne, Oakland, Genessee, and Ingham counties. For further information on these training opportunities contact: Dr. Douglas E. Lane, C.S. Mott Community College, 1401 East Court, Flint, Michigan 48503, (313) 762-0278, or Wayne Community College, Elaine Wallace, Coastal Environmental Studies, 8551 Greenfield, Detroit, Michigan 38228, (313) 584-9381.

Continuing Education

Registration by Mail

Eastern Michigan University

"Mail Registration" is recommended to assure a place in class. Please complete the "Registration by Mail" form below and return to the Registration Office at least one week prior to the first class meeting.

Mail to: Registration Office, Briggs Hall
Eastern Michigan University
Ypsilanti, Michigan 48197

E.M.U. Student No. _____

Social Security No. _____

Birthdate _____

For: Spring _____ (Apr.-Jun.) Summer _____ (Jun.-Aug.) Fall X (Aug.-Dec.) Winter _____ (Jan.-Apr.) 1980

Name _____
Last First Middle Maiden

Address _____

City & State _____ Zip _____

Telephone No.: _____ _____
Area Code Home Area Code Business

Do you hold credit from E.M.U.? ____ Yes ____ No IF YES ____ Undergraduate ____ Graduate

Enrollment Status: **DO YOU HOLD A BACHELOR'S DEGREE?** (Check appropriate boxes)

If Yes ☐

- ☐ Hold graduate admission at EMU
- ☐ Have applied for graduate admission at EMU, but have not been notified
- ☐ Have not applied, am enrolling as a NON MATRICULATED student*

If No ☐

- ☐ Hold undergraduate admission at EMU
- ☐ Have applied for undergraduate admission at EMU, but have not been notified
- ☐ Have not applied; am enrolling as a NON MATRICULATED student*

*Valid for one enrollment period pending completion of admission requirements. See appropriate admission's office. FAILURE TO COMPLETE THE ADMISSION PROCESS WILL RESULT IN AUTOMATIC CANCELLATION OF FUTURE ATTEMPTS TO REGISTER.

Check One:

	I.D. No.	Course No.	Course Title	Sem. Hours	Location
☐	79570	(Graduate) GE0478	"Special Topics: Remote Area Sensing"	2	Strong Hall
☐	79570	(Undergraduate)			
☐	82330	(Non-Credit)			

Payment by:

☐ Check (Made out to Eastern Michigan University)
☐ Master Charge No. _____ Expiration Date _____
☐ Visa No. _____ Expiration Date _____

Full amount: _____

Payment:
Fall/Winter - 50% tuition plus $20.00 registration fee per semester
Spring/Summer - 100% tuition plus $15.00 registration fee per session.
(add $10.00 late fee if applicable)

All fees subject to change by action of the Board of Regents

Non-Credit Special Programs - Pay Total Cost

Student's Signature _____ Date _____

APPENDIX C

Brochure on Wayne County Community College Coastal Enviornmental Studies Project. The Director of this project, Dr. Elaine Wallace, is organizing the seminar associated with the third cooperative technology transfer effort, 24 October to 19 December 1980.

WAYNE COUNTY COMMUNITY COLLEGE

FUNDED BY National Science Foundation

DIRECTOR:
Elaine Wallace
584-9381

RESEARCH COORDINATOR:
Charles P. Cubbage

SECRETARY:
Shirley Ulmer
584-9381

For further information on details of classes, please call Project Office:
584-9381
COASTAL ENVIROMENTAL STUDIES PROJECT
Greenfield Center - Annex Rooms 312, 319, and 321
8551 Greenfield Detroit, Michigan 48228

APPLICATION

for the

COASTAL ENVIRONMENTAL STUDIES PROJECT

NAME _____ TELEPHONE: Home _____ Work _____

STREET ADDRESS _____ CITY _____

STATE _____ ZIP CODE _____

DAY PROGRAM ☐

or

NIGHT PROGRAM ☐

PREFERRED ENTRANCE DATE

Year

Fall ____
Winter ____
Spring ____

Mail to: Coastal Environmental Studies Project
8551 Greenfield
Detroit, Michigan 48228

ASSOCIATE DEGREE REQUIREMENTS
(66 hours plus lab credit)

				CREDIT
I	**ENGLISH**			
	English	110	(writing)	3
		270	(scientific writing)	3
II	**SOCIAL SCIENCE:**			
	Geography	240	(coastal land usage)	3
	Political Science	101	(intro. to P.S.)	3
		140	(gov't, law, and environment)	3
III	**NATURAL SCIENCE:**			
	Chemistry	120 Lec.	(general I)	3
		125 Lab.	(water chemistry I)	4
		130 Lec.	(general II)	4
		135 Lab.	(water chemistry II)	4
	Math	113	(int. algeba)	3
		155	(college algebra)	3

SPRING-SUMMER

Geology	220	(field)	6
Biology	140	(limnology)	3
	141		2
		TOTAL	11

SEMESTER II:

Geology	210 Lec.	(physical)	3
	211 Lab.		2
Chemistry	130	(general II)	4
	135	(water chemistry II)	4
Geography	240	(coastal land usage)	3
Coastal Environmental Science	201	(coastal environ. seminar)	1
English	270	(science writing)	3
		TOTAL	20

Property damage caused by 1946-1952 high lake levels.

Lake Michigan (right)

PURPOSE:

The purpose of the Coastal Environmental Studies Project is to develop a Certificate Program and an Associate Degree Program in Coastal Environmental Studies in collaboration with the Engineering and Geography Departments at Wayne State University, the Michigan Sea Grant Program, the Michigan Department of Natural Resources, and other local agencies. Students will be trained for careers as aides, technicians, and attendants in; (1) coastal research, (2) environmental studies, and (3) chemical engineering. Students will participate in on-site visits along the shorelines of Michigan. Twenty permanent field sites will be set up for field testing and observation.

GOALS:

The goals of this project, which is funded by the National Science Foundation, are to (1) provide two year college students with skills and training that will make them employable in science related fields, (2) provide an in-service training program for on-the-job employees who need or desire training because of new technology, (3) provide minority students with the opportunity to spend time in practical learning situations that will augment the formal science training they receive in the classroom and (4) prepare students for future study at other institutions in the field of engineering, geography, geology, chemistry, biology, etc. The educational value of coastal environment studies to Wayne County Community College students is clear. The project is designed to encourage students to pursue science careers and develop skills that will prepare them for meaningful employment.

RECOMMENDED

SCHEDULE

COASTAL-ENVIRONMENTAL STUDIES

CERTIFICATE

SEMESTER I			**CREDITS**
Coastal Environ. Sci.	101	(career orientation)	1
Geography	230	(aerial photo and topo. maps)	4
Physical Science	120	(intro. to lab math	3
Chemistry	120 Lec.	(general I)	3
	125 Lab.	(water chemistry I)	4
Political Science	140	(government, law, and the environ.)	3
Computer and Data Processing	123	(language lab I: BASCI)	2
		TOTAL	20

Coastal Environmental Science	101	(career orientation)	1
	201	(coastal environmental seminar)	1
Physical Science	120	(introduction to lab: math)	3
Computer and Data Processing	123	(language lab I: BASIC)	2
Geology	210 Lec.	(physical)	3
	211 Lab.		2
	220	(field)	6
Biology	110 Lec.	(basic prin.)	4
	111 Lab.		2
	140 Lec.	(limnology)	3
	141 Lab.		2
Geography	230	(aerial photo and topo. maps) interpertation and construction	4
IV HUMANITIES		(2 courses req.)	6

SEMESTER OFFERED

FALL			CREDITS
Biology	110 Lec.	(basic principles)	4
	111 Lab.		2
Chemistry	120 Lec.	(general I)	3
	130 Lec.	(general II)	4
	135 Lab.	(water chemistry II)	4
Coastal Environ. Science	101	(career orientation)	1
Computer and Date Processing	123	(lang. Lab I: BASIC)	2
English	110	(writing)	3
	270	(scientific writing)	3
Geography	240	(coastal land usage)	3
Geology	210 Lec.	(physical)	3
	211 Lab.		2
Humanities		(two courses)	6
Math	113	(int. algebra)	3
	155	(college algebra)	3
Physical Science	120	(introduction to laboratory math)	3
Political Science	101	(introduction to P.S.)	3

SPRING-SUMMER			
Geology	220	(field)	6
Biology	140 Lec.	(limnology)	3
	141 Lab.		2
		TOTAL	11

SEMESTER III			
Chemistry	130 Lec.	(general II)	4
	135 Lab.	(water chemistry II)	4
Math	155	(college algebra)	3
Geography	240	(coastal land usage)	3
English	270	(science writing)	3
		TOTAL	17

SEMESTER IV			
Humanities		(two courses)	6
Coastal Environ. Sci.	201	(coastal environmental seminar)	1
Political Science	101	(introduction to P.S.)	3
		TOTAL	10
		TOTAL (66 plus lab credit)	**75**

RECOMMENDED

SCHEDULE

COASTAL-ENVIRONMENTAL STUDIES

ASSOCIATE DEGREE

SEMESTER I			**CREDITS**
English	110	(writing)	3
Geology	210 Lec.	(physical)	3
	211 Lab.		2
Math	113	(int. algebra)	3
Biology	110 Lec.	(basic principles)	4
	111 Lab.		2
Coastal Environ. Sci.	101	(career orientation)	1
		TOTAL	18
SEMESTER II			
Geography (sci. cr.)	230	(aerial photo and topo. maps)	4
Physical Science	120	(intro. to lab. math)	3
Chemistry	120 Lec.	(general I)	3
	125 Lab.	(water chemistry I)	4
Political Science	140	(gov't, law, and environment)	3
Computer and Data Processing	123	(language lab I: BASIC)	2
		TOTAL	19
WINTER			
Biology	110 Lec.	(basic principles)	4
	111 Lab.		2
Chemistry	120 Lec.	(general I)	3
	125 Lab.	(water chemistry I)	4
	130 Lec.	(general II)	4
Coastal Environ. Sci.	201	(coastal environmental seminar)	1
Computer and Data Pro.	123	(land. lab. I: BASIC)	2
English	110	(writing)	3
	270	(scientific writing)	3
Geography	230	(aerial photo and topo. maps)	4
Geology	210 Lec.	(physical)	3
	211 Lab.		2
Humanities		(two chourses)	6
Math	113	(int. algebra)	3
	155	(college algebra)	3
Physical Science	120	(introduction to laboratory math)	3
Political Science	101	(introduction to P.S.)	3
	140	(government, law, and the environ.)	3
SPRING-SUMMER			
Geology	220	(field)	6
Biology	140 Lec.	(limnology)	3
	141 Lab.		2

CERTIFICATE REQUIREMENTS

Geology	210 Lec.	(physical)	3
	211 Lab.		2
	220	(field)	6
Coastal Environmental Science	101	(career orientation)	1
	201	(coastal environmental seminar)	1
Physical Science	120	(intro. to laboratory math)	3
Computer and Data Processing	123	(language lab. I: BASIC)	2
Chemistry	120 Lec.	(general I)	3
	125 Lab.	(water chemistry I)	4
	130 Lec.	(general II)	4
	135 Lab.	(water chemistry II)	4
Geography	230	(aerial photo and topo. maps)	4
	240	(coastal land usage)	3
Biology	140 Lec.	(limnology)	3
	141 Lab.		2
Political Science	140	(government, law, and the environ.)	3
English	270	(science writing)	3

CAREERS

1. Jobs

Aides and Technicians

Urban Planning Technicians
Surveying Technicians
Statistician Aides
Coastal Resources
Aides to Recreational Personnel
Coastal Zone Management
Natural Resources
Army Corps of Engineering Aides
Fisheries Technicians
Chemical Technicians
Aquatic Ecologist Aides
Water Pollution Technicans
Applied Statistician Aides
Deck Support Technicians

2. Advanced Studies at 4 yr. Institute

Engineering
Geology
Coastal Environment
Urban Management
Biology

APPENDIX D

Summary description of the Remote Analysis System (RAS) being used to support the Landsat training and demonstration activity.

RAS OPERATING INSTRUCTIONS

I. INTRODUCTION

A. The RAS System:

The Remote Analysis Station (RAS) consists of a color CRT imagery display, with alphanumeric overwrite and keyboard, as well as a cursor controller and modem (Figure 1). This portable station can communicate via modem and dial-up telephone with a host computer at 1200 baud or hardwired to a host computer at 9600 baud. The station contains a Z80 microcomputer which controls the display refresh memory and remote station processing. Landsat data is displayed as three-band false-color imagery, one-band color sliced imagery, or color-coded processed imagery. Although the display memory routinely operates at 256 x 256 picture elements, a display resolution of 128 x 128 can be selected to fill the display faster.

The slowest filling of the display would be for three-band false color imagery. False color display fill rates for the various resolution and baud rates are shown in the following table. The single band color sliced and categorized images (with less than 16 categories) will fill the display at twice the indicated false color rates.

APPROXIMATE FALSE COLOR DISPLAY FILL RATE AND RESOLUTION

Baud Rate	Display Resolution-Pixels	
	128 x 128	256 x 256
1200 (Dial Line)	120 sec.	8.5 min.
9600 (Local Line)	15 sec.	64 sec.

The interactive operating techniques developed for RAS permit most of the interaction to be performed at lower resolutions and faster display fill rates, with the high resolution capability used for viewing the final processed data. The key to the relatively rapid fill rate is that the data being transmitted to the RAS by the

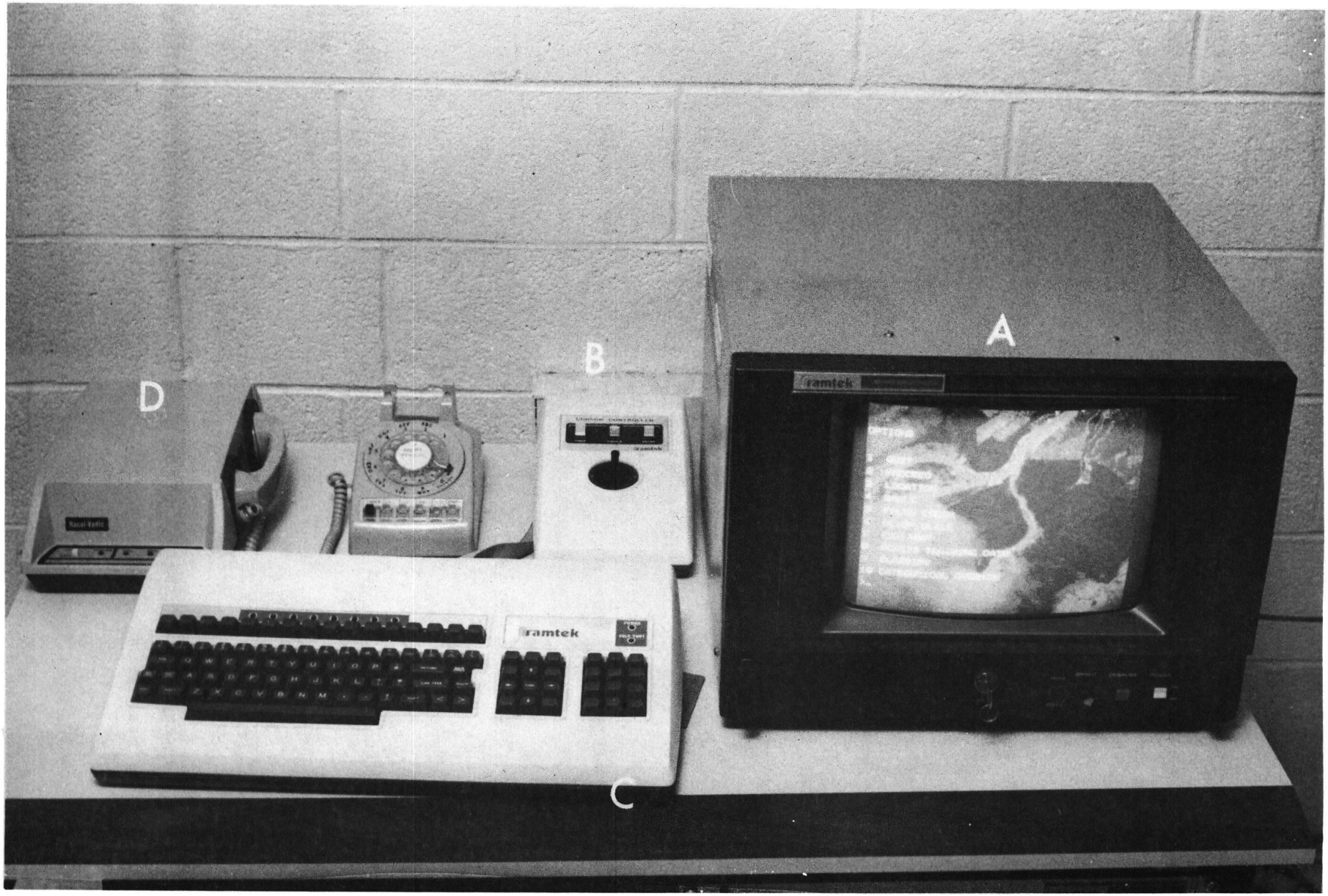


Figure 1
Remote Analysis Station

host computer are already scaled to 3 bits per color, display resolution for the 3 CRT guns (red, green, and blue) prior to transmission with one bit, for graphics overwrite.

The RAS features the following capabilities:

- Low cost - the station can be assembled from readily available hardware for less than $20,000
- System portability - the user supplies only electrical outlets, and telephone
- Interactive control via a simple, menu-driven language
- Dial-up access to host computer with selectable trade-off between image viewing speed and quality (resolution)
- Histogram display, categorization accuracy tables, and results of category separation analysis
- Categorized image display in colors selected from list with over 40 options
- Edit colors within areas enclosed via cursor - 'digital air brush'
- Generation of land cover tabulations directly from display by designating boundary of area with cursor
- Display of selected map categories over false color images
- Input of image and map control points for geometric correction
- Generate electronic service request for initial Landsat files, and subsequent image and data products.

Integration of RAS with host computer

During this program the host computer for the RAS has been the PDP 11/70 computer in ERIM's Earth Resources Data Center (ERDC). Figure 2 illustrates the RAS - linked to its host via phone line and modem. The PDP 11/70 peripherials consist of the following:

- 1000K bytes of memory
- Four 176 megabyte disks
- Two 2.5 megabyte program disks
- Four 9-track computer tape transports
- Two interactive display stations
- One 16-channel terminal multiplexer
- Two telephone modems
- Datagrid digitizer table
- Optronics drum film recorder
- Two hardwired high-speed maximum likelihood processors.

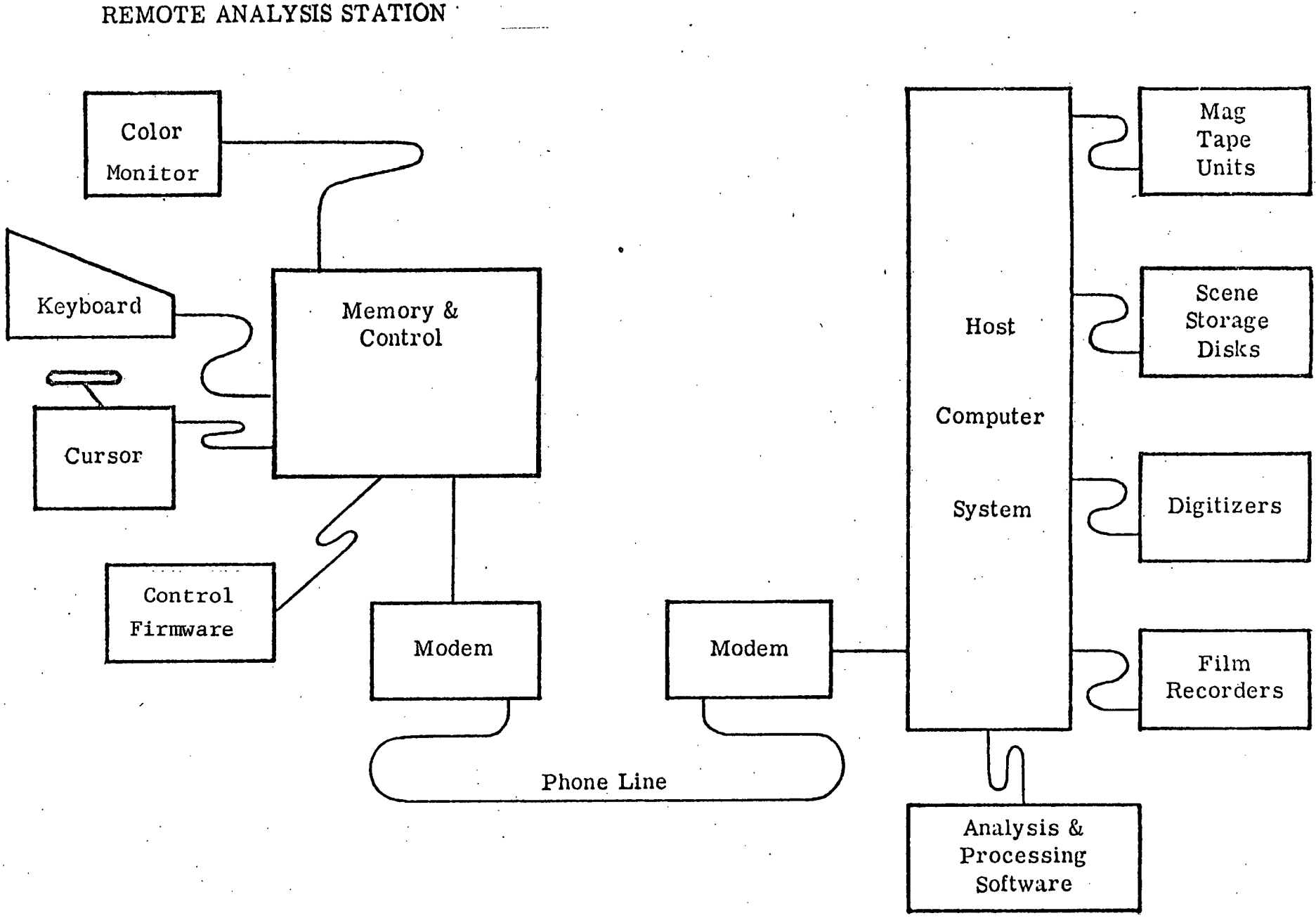


Figure 2. RAS and Host Computer

B. RAS Operation

RAS features interactive control via a simple, menu-driven language. Table 1 lists the present 6-Option menu with sub-menus and the most frequently used off-line programs. After the user has logged in, operation is initiated by display of the six major options. To call one of the sub-menus, the user simply enters the appropriate letter, e.g., "R" for RADIOMETRIC and the corresponding options, false color, color slice, contrast etc., appear. Selection of one of these results in further options, e.g., band-color assignment, gain - offset levels, etc.

Each submenu pertains to a set of related options. The option QUIT is rather straight forward. RADIOMETRIC options are those which operate on the spectral or radiometric content of the data. In contrast, the GEOMETRIC options include functions such as Location and Scale which are spatial or geometric in nature. Functions relating to training sets are contained within the TRAINING DATA menu. The MULTISOURCE PROCESSING submenu involves data from several sources as well as allows the user to manipulate and edit a previously categorized file. At present the UTILITIES option consists only of a Pause and Stop option. The PAUSE mode facilitates the temporary interruption of the RAS program for running off-line programs on an associated hard copy device, when available. Most of the performance statistics are run off-line so as not to unduly enlarge the basic RAS software.

C. Summary of Operational Steps

As indicated by the flow diagram, the RAS user may initiate a project at several different stages in the processing path (Figure 3). Many users will want to begin with a subscene which has been geometrically corrected, restored and resampled. Others who are more cost conscious may wish to process a raw LANDSAT subscene and perform a geometric correction after the creation of a categorized file. The following events describe those typically used by RAS operators to process LANDSAT data:

Table 1. RAS 6-Option Menu and frequently used off-line programs

1. QUIT (Q)

2. RADIOMETRIC OPTIONS (R)
   1 FALSE COLOR
   2 COLOR SLICE
   3 CONTRAST
   4 CATEGORIZE

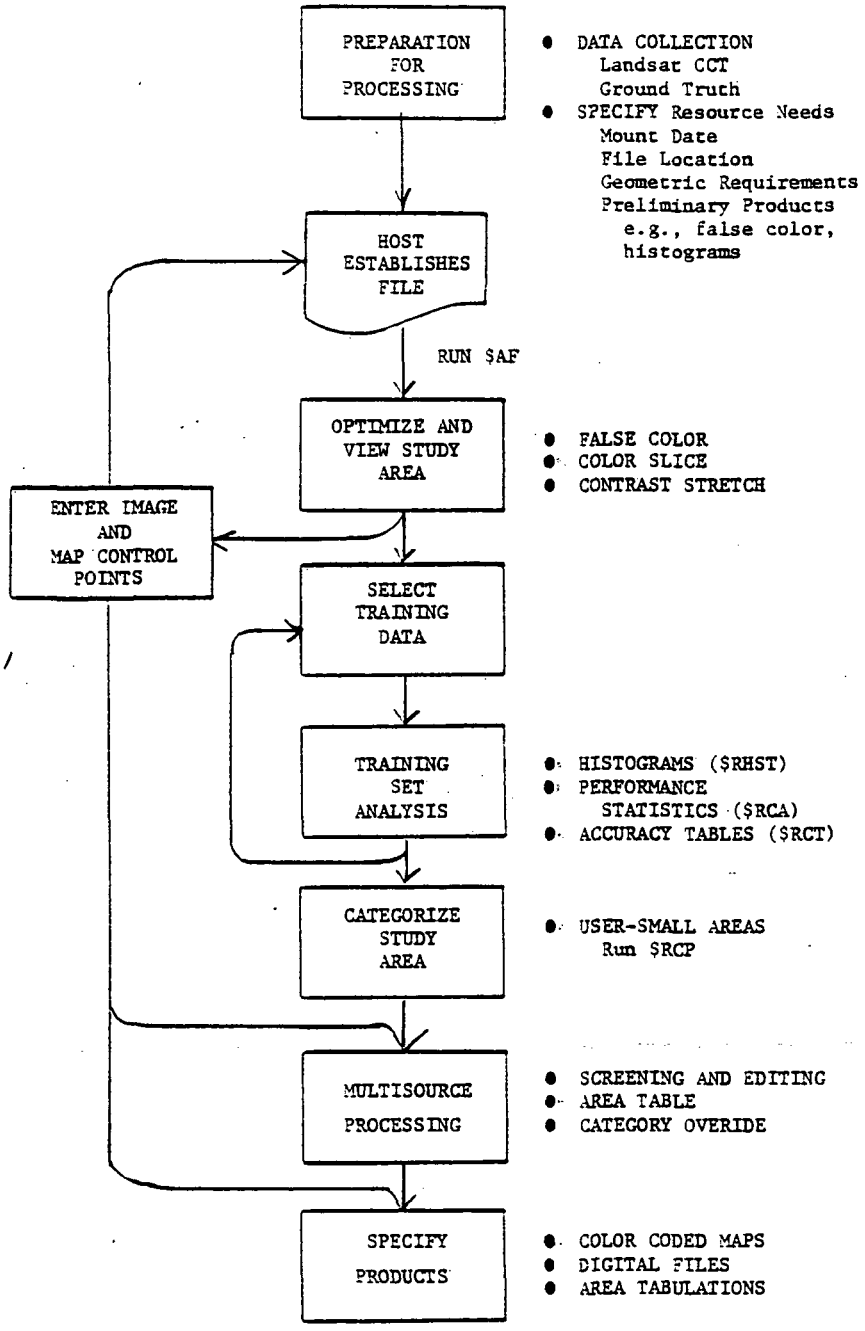
3. GEOMETRIC OPTIONS (G)
   1 LOCATION
   2 SCALE
   3 IMAGE CONTROL POINTS

4. TRAINING DATA (T)
   ENTER TRAINING SET NUMBER?
   ENTER UPPER LEFT CORNER
   ENTER UPPER RIGHT CORNER
   ENTER LOWER RIGHT CORNER
   ENTER LOWER LEFT CORNER
   NAME?
   GROUP NUMBER & COLOR?

5. MULTISOURCE PROCESSING (M)
   1 CATEGORICAL DISPLAY
   2 CATEGORICAL OVERIDE
   3 CO-OCCURRENCES
   4 EDIT
   5 AREA TABLES

6. UTILITIES (U)
   1 PAUSE
   2 STOP

7. FREQUENTLY USED OFF-LINE PROGRAMS
   1 TRAINING SET HISTOGRAMS ($RHST)
   2 REMOTE CATEGORICAL ANALYSIS ($RCA)
   3 ACCURACY TABLES ($RCT)
   4 REMOTE CATEGORICAL PROCESSING ($RCP)
   5 ELECTRONIC SERVICE REQUEST ($ESR)
   6 TEXT EDITOR (EDI)



Denotes Point where information may be entered by Electronic Service Request (ESR)

Figure 3. Flow chart illustrating the steps in processing a subscene using the RAS terminal

1. Data Collection. Prior to processing, the user acquires: LANDSAT Computer Compatible Tape (CCT), aerial photography, maps and other ground truth data needed to locate training areas for land cover categories; and, topographic maps needed for geometric corrections.

2. Specify study area and preliminary products. The user sends his Landsat tape to the host computer facility together with information needed to establish initial LANDSAT files of study areas. Information needed includes "mount" date, location of file in Landsat coordinates, and specifications for geometric corrections. If host is to input image and map control points for corrections, the user will also forward the topographic maps to the host facility. The user may also request histograms and a false color print of the study area at this time.

3. Establish link with files. At the specified mount date, the host computer reads the study area onto a disk and into the user's assigned file. The user should have at this time a RAS User's Manual, histograms, ground truth data (e.g., aerial photos and LANDSAT false color images) annotated with possible training site locations, and topographic maps, if ground control points are to be entered through the terminal. The user "dials up" the host computer. Two outside telephones have been established for this project.

4. Optimize and view study area and ground control point input option. Using selections from the Radiometric and Geometric submenus, the user will call up a display full of data from his disk area by scan line and pixel number. After general familiarization with the file, the user will optimize the false color and level sliced picture with the aid of the Histogram and Contrast display mode. If the data has not been corrected for geometric distortions, the user can elect to enter the image and map control points at this time or at any other time preceeding the generation of the final map and data products.

Geometric considerations are reviewed further in a following section.

5. Select training data. Once map category needs have been established, and potential training set areas have been located on the display with the aid of ground truth data, the user begins to select training sets. More than one training set can be selected from the display without moving to another image location. Operating in the Training Data mode, training sets are selected using a quadrilateral cursor, and the cursor coordinates along with training set identification and color codes are transmitted to the host computer.

6. Training set analysis. The user proceeds to interactive analysis after initial training sets are selected. This involves running the off-line Remote Categorical Analysis (RCA) program to establish processing coefficients (Walsh, 79, Wilson, 79) and selection of the Categorize option to display the processed data. Typically, the first analysis is performed after 6-8 training sets are selected. Categorized data on the display, together with statistical printouts (as overwrite) are reviewed, and then training sets refined and additional training sets selected until the desired results for up to 50 categories are available. Typically, 10 to 25 training sets for 6 to 15 map categories are selected. The categories are then aggregated down to the desired number of final map categories.

Statistics generated from off-line programs, such as RCA, ACCURACY TABLES (RCT), and TRAINING SET HISTOGRAMS (RHST), are viewed on display or on line printer. If the printer is not available, the display must be photographed if the information is to be retrieved before hard copy from the host computer arrives. When categorize is selected from the RADIOMETRIC submenu, the user views the interpreted data as it is being processed by the host computer with parameters computed by RCA from training data. Processing accuracy is often assessed by comparing this color-coded image with aerial photographs and other ground truth data. Some users photograph the display for more detailed analysis at a more convenienct time. To minimize cost, many training and

demonstration projects end Landsat categorization activity at this point using the photographs and statistics to document the projects.

7. Apply analysis results to categorize study area. Presuming the categorization is satisfactory, the user can categorize the entire file (study area) with Remote Categorical Processing (RCP), through the Electronic Service Request (ESR) program. Unless the files are relatively small (e.g., county or smaller) the categorization should be referred to the host which can process the files more efficiently with its hardwired high-speed processors.

8. Multisource processing. After the area of interest has been categorized and placed in the user's working area, some of the following multisources processing options can be selected as needed to manipulate and edit the processed data.
1. Categorical display. Categorical display can be requested to review the processed file. Since the interpreted file can be displayed much faster than files being processing, the user may select this mode to preview the file at a higher resolution than that accomplished during Land cover analysis. 2. Editing. Editing permits the user to change colors in any area enclosed with cursor. When this "digital airbrush" activity is accomplished by a careful operator with good ground truth, the effort can result in a significant improvement in classification accuracy. This option is also used to demonstrate how data from other sources (e.g., aerial photos, maps, etc.), can be integrated into Landsat files. 3. Area tables. Area tables generated from categorized data bounded by cursor on display lists acres, square kilometers, and percentage of area occupied by each land cover category. When boundaries of areas are complex or not visible on image, the host facility digitizes the boundary from maps supplied by the user and generates tabulations.

9. Specifying products. The user selects theme colors, and map products (scale and projection), digital files, area tabulation, etc. and transmits the order to the host computer via an Electronic Service Request. The products are generated off-line and sent to the user.

10. Geometric corrections. The user can contribute to geometric corrections if needed prior to or following training set analysis. In either case, the RAS user simply enters the image and map control points and receives an analysis of mapping error based on their use.

If corrections are needed, user specified options include: 1) when corrections are to be made; 2) whether RAS or host is providing image and map control points; 3) desired map projection and cell size; 4) mapping transformation or model (i.e., affine, nonmodel, or rigid model); and, 5) resampling algorithm (e.g., nearest neighbor, cubic convolution, restoration). Details of these options have been well documented (Wilson, 80). If corrections are performed before land cover analysis, the host establishes a corrected file in the users area. This file can be generated with virtually any map projection and cell size. A typical file would be in the UTM projection with 50 meter x 50 meter square cell. The cells would be east-west oriented with north imaged at the top of the display. This display facilitates comparison of Landsat image with available photographs and maps as well as location of potential training areas.

If geometric corrections are established with support from the terminal, the host first establishes uncorrected files. The image coordinate of map control points are located on the false color display and transmitted to the host computer when the Image Control Point option of the GEOMETRIC menu is executed with the cursor over the image control point. Latitude and longitude of corresponding points are derived from topographic maps and entered through the keyboard with off-line TEXT EDITOR (EDI) program. The Electronic Service Request (ESR) or other means can be used to inform the host of the selection of processing algorithms. Residual errors are transmitted to the user for review.

II. START-UP INSTRUCTIONS

A. Initial Equipment and Material Needs

For most RAS users, the following equipment and materials will be provided:

1. RAS Color Terminal with keyboard, acoustical coupler, and cursor controller.
2. RAS User's Manual.
3. Working file area assignment at ERIM's ERDC, including password.
4. LANDSAT subscene placed on disk at ERIM's ERDC. Submit Service Request of ground control points, geometric correction, or restoration desired.
5. Scene Title.
6. Disk Drive Number.
7. Color List from ERDC.
8. Histograms for Contrast Stretch.

The following will be supplied by the RAS user:

1. *Ground truth materials, such as maps and aerial photographs.
2. *Hard-copy output device, such as a decwriter if needed.
3. *35MM Camera or Polaroid with tripod.
4. *Telephone, conventional type. Phone numbers are listed in RAS User's Manual.

The user is also expected to ensure that electrical outlets, a swivel chair, and other office materials are available. Access to an additional phone may be necessary so that RAS hotline calls can be made to ERIM's ERDC at 313/994-1200, Ext. 576. This extra phone can be used for the hard-copy terminal.

B. Turning on the RAS

Plug in the main power plug.

Since the keyboard display screens, and cursor controller are interconnected, there is just one plug. Turn on power switch below the display screen and next the power switch in the keyboard.

C. Dialing in to ERIM:

At present there are four phone lines at ERIM's ERDC reserved for RAS use. The RAS acoustical coupler is linked to 1200 baud lines, whereas most hard-copy terminals are usually connected to 300 baud lines. Also note the teletype assignments.

1200 Baud Phone Lines	TTY Assignments
Listed on Modem	27
	30

300 Baud Phone Lines	TTY Assignments
Listed on Modem	25
	26

After calling one of the above phone numbers, and hearing a high-pitched tone, set the phone receiver into the acoustical coupler. Be sure to place the receiver of the phone in the appropriate end of the coupler.

A light on the modem will light up when the phone link to ERIM has been established.

Should the telephone be hung up accidentally while in the RAS program, simply phone in again. The user remains logged on until he quits and logs off. It is important to log off when finished interacting with the computer, as the RAS user is charged for connect-time.

III. LOGGING ON AND LOGGING OFF

A. Logging On

The RAS user is supplied with the following information to enable him to logon to the ERDC's PDP11/70.

1. U.I.C. number
2. Password.

Follow the interactive commands below; the commands in italics are those which appear on the RAS display screen. A <CR> indicates a carriage return.

Example

>HELLO 99,9 <CR>

Enter the correct 3-digit U.I.C.

PASSWORD: XYZZY <CR>

After entering the password, the computer will respond with a logon message, telling the RAS user his terminal number, the time of day, and any message of the day. When logging onto the ERDC, the RAS user should make note of any scheduled computer maintenance or shut-down. A two-way communication line now exists between the ERDC and the RAS. The user may now run one of the many programs listed, beginning with Section VI.

B. Logging Off

Once a RAS working session is complete, it is necessary to cut the line of communication between the RAS and the ERDC. Do Not hang-up the telephone until the user logs off. Doing so will cause the user problems due to locked files or a "hung task". Once a program has terminated, the user may logoff. Logging off is accomplished by entering "BYE" <CR>. A logoff message i.e., have a good afternoon etc., followed by some numbers indicating connect time, I/O counts, etc., will scroll onto the screen. The connection with the computer is now disconnected, and the telephone may be hung-up and the RAS system powered down.

IV. FILE ALLOCATION PROGRAM ($AF)

Prior to viewing digital data with the RAS program several computer files must first be created. Two files will be created for the RAS user in his U.I.C. One of these is the actual image file to be viewed. The second file contains all pertinent information regarding the image file. This is the "Header" File. Several other files need to be created before viewing data. To facilitate this a File Allocation program has been written. The AF program creates three additional files each time it is run.

1. PRM.001 This file contains a user-inputed problem description.
2. DSL.001 This file contains the location of all training sets in X & Y coordinates.
3. CLL.001 This file contains the color list.

Because the RAS program utilizes all three of these computer files, AF must be run.

NOTE: Once these files have been created there is no need to run AF again! Therefore, AF is run at the beginning of a project only. The files created by AF are stored on disk, so a RAS user may use the same problem description file, training set location file & color list each time he logs on without re-running AF.

Review the following interactive dialog:

RUN $AF <CR>

ENTER NO. OF BANDS TO BE PROCESSED: 4 <CR>

A 4 is entered for LANDSAT data. DO NOT enter a blank.